

Description



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Switching device withdrawable part for a switchgear assembly having auxiliary disconnection contacts

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The invention relates to a switching device withdrawable part for a switchgear assembly having auxiliary disconnection contacts which can be closed or opened by means of an operating apparatus which is accessible from a front control panel and is arranged on the switching device withdrawable part, with a contact unit which is associated with the auxiliary disconnection contacts being guided by means of a slide on the switching device withdrawable part such that it can move.

A switching device withdrawable part of this type has been disclosed, for example, in DE 199 48 697 A1. In this case, the contact unit is arranged on the rear face of the switching device withdrawable part, and can be operated by means of a grip (knob or the like) which is provided on the front control panel of the switching device withdrawable part. The grip is fitted to the slide, which is intended for use as means for guiding the contact unit such that it can be moved in a straight line. The grip therefore assumes a position which projects relative to the front control panel when the auxiliary disconnection contacts are not engaged.

For main disconnection contacts, it is already known in the case of a switching device withdrawable part according to DE 27 17 691 A1 for a worm drive to be used, which can be operated by a tool on the front control panel of the switching device withdrawable part. In this case, a worm moves a slide, which is fitted with contact units of the main disconnection contacts, close to the rear face of the switching device withdrawable part. The same known switching



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device withdrawable part has auxiliary disconnection contacts which, however, are positively engaged with one another during insertion of the switching device withdrawable part into an associated switchgear assembly. These auxiliary disconnection contacts do not become effective, however, until the worm drive of the main disconnection contacts is operated, since an auxiliary switch

is coupled to the worm drive and enables the auxiliary voltage for operation of the contactors etc.

5 A further switching device withdrawable part is described in the prior patent application DE 101 20 737.9 dated April 20, 2001, with the note that auxiliary disconnection contacts can be operated by a worm drive or screw drive similar to that in DE 27 17 691 A1.

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The invention is based on the object of improving the operation of auxiliary disconnection contacts in switching device withdrawable parts, and for this purpose provides that the operating apparatus has a shaft which is mounted in the switching device withdrawable part such that it can rotate and can be operated by means of a tool, and in that a slotted-link arrangement is fitted to the slide and interacts with a control pin which projects radially from the shaft.

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The operating apparatus according to the invention can be produced and installed more easily, with the same advantageous function as that in the case of the worm arrangement according to DE 27 17 691 A1. In particular, this allows a slotted-link arrangement to be associated with the slide of the contact unit, with both parts (slide and slotted-link arrangement) being in the form of an integral sheet-metal part. However, if there is a need for a greater force to be transmitted, as may be desirable, for example, in the case of multipole auxiliary disconnection contacts, then, according to one refinement of the invention, an appropriate movement sequence can be achieved in that the slotted-link arrangement has a worm gear with at least two sections with different pitches, of which one section has an increased force step-up ratio, which is suitable for closing the auxiliary disconnection contacts with respect to rotation of the shaft. The

other

section is in this case expediently of such a size that the idling movement of the contact unit from its rest position until the contacts first touch the stationary part of the auxiliary disconnection contacts takes
5 place over a relatively short rotation angle of the shaft.

A slotted-link arrangement having this characteristic can advantageously be designed such that two
10 slotted-link bodies are provided, which are firmly connected to the slide, are hollow and cylindrical and are arranged coaxially with respect to the shaft, and whose mutually facing end surfaces bound a worm gear which holds the control pin. The separate slotted-link
15 bodies can be produced considerably more easily than an integral worm body and make it possible to produce the desired relationship between the operating travel or rotation angle of the force to be applied, with little effort.

20 A further useful modification, which can be implemented easily owing to the axially split slotted-link arrangement, may comprise the worm gear having a section with the opposite pitch at at least one end,
25 and a spring which axially prestresses the slotted-link arrangement producing a latch for the shaft in one end position.

As already mentioned in the introduction, the essence
30 of the invention includes a simple production capability and easy installation of the auxiliary disconnection contact arrangement. This can be contributed to by the slotted-link bodies each having a radially projecting flange, and the slide having a
35 supporting limb which can be connected to the flanges. The dimensions of the supporting limb and of the flanges in this case at the same time ensure the necessary distance between the slotted-link

bodies for the control pin to engage in. The flanges and the supporting limb are in this case expediently arranged parallel to one another and are connected by means of continuous attachment means such that they are
5 aligned and cannot rotate.

As is known per se, the shaft may be provided at the end with a contour which is suitable for connection to a tool. In this case, both removable tools in the form
10 of a known hand crank and tools such as a rotary knob which are permanently connected to the shaft are suitable for operating the shaft.

The invention will be explained in more detail in the
15 following text with reference to the exemplary embodiment which is illustrated in the figures.

Figure 1 shows a plan view of a switching device withdrawable part for a low-voltage switchgear assembly
20 having an operating apparatus for auxiliary disconnection contacts.

Figure 2 shows, as a first example of an operating apparatus, a slide having a slotted-link arrangement
25 fitted to it, in conjunction with a shaft which is intended for operating the slide.

Figure 3 shows a further example of an operating apparatus for the auxiliary disconnection contacts in
30 the assembled state, together with a slide as a mount for a moveable contact unit for the auxiliary disconnection contacts.

Figure 4 shows the major components of the operating
35 apparatus as shown in Figure 3, in the form of a perspective, exploded illustration.

Figure 5 shows a perspective illustration of the right-hand front corner of the switching device withdrawable part shown in Figure 1, with the operating apparatus for the auxiliary disconnection contacts as shown in Figures 3 and 4 being located in the "auxiliary disconnection contacts open" position.

Figure 6 shows an illustration corresponding to that in Figure 5, with the operating apparatus being located in the "auxiliary disconnection contacts closed" position.

A switching device withdrawable part 1, a plan view of which is shown in Figure 1, for a low-voltage switchgear assembly has a frame or housing 2, on whose front face a front control panel 3 with handles 4 and 5 is located, and on whose rear face main disconnection contacts 6 and 7 as well as auxiliary disconnection contacts 8 are located. In this case, the main disconnection contacts 6 are used for feeding power, while the main disconnection contacts 7 represent a load outgoer. The main disconnection contacts 6 and 7 are engaged in a known manner with fixed-position vertical busbars and opposing contacts 10 and 11 by movement of the switching device withdrawable part 1 in the direction of an arrow 12, and are disconnected from them by movement in the direction of an arrow 13. The auxiliary disconnection contacts 8 have an associated contact unit 14, which is attached to the rear end of a slide 15 which is guided such that it can move in a straight line in the frame 2. The slide 15 can likewise be moved in the direction of the arrows 12 and 13 by respective operating apparatuses 16 and 19, which will be explained in more detail later.

The switching device withdrawable part 1 furthermore has a mounting plate 17, which is arranged parallel to the front control panel 3, for switching, control and protection devices. Of these, only one main switch 18

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is indicated, which can be operated by means of a

rotary handle 20 located on the front control panel 3. Furthermore, the switching device withdrawable part 1 has a locking bar 21 which extends essentially over the entire width of the frame 2, is mounted by means of
5 pivoting arms 22 and 23 in side walls of the frame 2 such that it can pivot, and has locking tabs 24 and 25 which project beyond the frame 2 and interact with fixed-position slotted links, which are not shown. These are used in a known manner to secure the
10 switching device withdrawable part 1 in particular in the "disconnected" and "connected" positions, and at the same time to ensure the necessary interlocks with respect to the main switch 18 and, if appropriate, with respect to a drive operator. A threaded spindle 26 with
15 an associated hand crank 27 which can be fitted as required as components of such a drive operator are likewise shown in Figure 1. A tool 28, which may be in a similar form to the hand crank 27 or may be a key, is indicated as means for operating the operating
20 apparatuses 16 and 19.

A first exemplary embodiment of an operating apparatus for the auxiliary disconnection contacts 8 will be explained first of all with reference to the figure.

25 Figure 2 shows a schematic perspective illustration without the guide and bearing parts of the housing 2 (Figure 2). A slide 30 is shown broken off, and is provided with a slotted-link arrangement 31. This has a
30 slotted-link body 32, which is in the form of a sheet-metal part and has a worm gear 33. In this case, the slotted-link body 32 together with the slide 30 can form an integral stamped part into which, when it is still flat, the worm gear 32 is incorporated as a slot
35 by stamping. The slotted-link body 32 is then shaped by bending to the illustrated open or closed cylindrical

shape, which is matched to a shaft 34. The same advantage of the capability for simple production of the worm gear 33 is achieved if the slotted-link body 32 is produced as a separate part and is connected to the slide 30 in some suitable manner. In this case, the shaping to form the illustrated hollow cylindrical form may be carried out either before or after the connection to the slide 30.

Figure 2 illustrates the shaft 34 at a distance from the slotted-link arrangement 31, in order to conceal the slotted-link body 32 to a lesser extent. A dashed-dotted line 35 indicates that a control pin 36, which is seated in the shaft 34 and projects radially, is provided for engaging in the worm gear 33. In its installed position, the shaft is mounted such that it can rotate (for example in the front control panel 3 in Figure 1) and is supported against axial movement. At the end, the shaft 34 is provided with a contour 37, which is illustrated as a quadrilateral attachment. A tool which matches the contour 37 (see the tool 28 in Figure 1) allows the shaft 34 to be rotated as indicated by the arrow 38, thus moving the slide 30 as indicated by an arrow 39.

Figure 2 indicates that the worm gear 33 has two sections 40 and 41, which have different pitches. This configuration means that the slide 30 travels through different distances for the same rotation angle of the shaft 34, when the control pin 36 is located in the section 40 or in the section 41. While the auxiliary disconnection contacts 8 are being closed, this results in a fast feed movement until the contacts touch, after which a relatively small operating force is required on the tool for the shaft 34, despite the greater amount of force required for engagement of the contact elements.

A further exemplary embodiment of an operating apparatus 19 will be explained in the following text with reference to Figures 3 and 4. In this case, the operating apparatus 19 is illustrated in the installed state in Figure 3, and in perspective, in the broken down state, in Figure 4.

In a similar way to Figure 2, Figure 3 shows a slide 42 which is provided with a slotted-link arrangement 43. This surrounds a shaft 44, which engages by means of a control pin 45 in a worm gear 46. At the end, the shaft 44 is provided with a shutter collar 47, which has a viewing window 48 for inscriptions on the front control panel (3 in Figure 1) as well as an opening for access to a contour 49 of the shaft 44.

As is shown in Figure 4, the slotted-link arrangement 43 comprises two slotted-link bodies 50 and 51, whose mutually facing end faces 52 and 53, respectively, form the worm gear 46. The separation which is required for this purpose is achieved by flanges 54 and 55, which project radially from the slotted-link bodies 50 and 51 and are provided with through-holes 56 for connection and attachment. In order to allow simple installation without adjustment, the flange 55 is provided with two prismatic pins which project in the direction of the flange 54, and which are held in recesses 58 in the flange 54. A recess 59 is arranged in that end surface of the slotted-link body 51 which forms one wall of the worm gear 46, and the control pin 45 (Figure 3), which is concealed in Figure 4, can enter this recess 59 under the influence of an axially acting spring 60. The arrangement results in a latch at the end of the worm gear 46. An identical depression can be arranged in the same sense at the opposite end of the worm gear (concealed in Figure 4).

The slide 42 is provided with a supporting limb 61 in order to connect the slotted-link arrangement 43 to the slide 42. The shutter collar 47 is provided with a tubular attachment 62, which is matched to a
5 cylindrical step 63 on the shaft 44 and can be connected to it by means of a pin 64. The slide 42 (Figure 3) is provided at its rear end with an angled mounting limb 65 for holding the contact unit 14.

10 The operating apparatus which has been explained with reference to Figures 3 and 4 is shown in the installed state in Figures 5 and 6, together with the front right-hand corner of the switching device withdrawable part 1 as shown in Figure 1.

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In addition to the parts which have already been explained with reference to Figure 1, in particular the front control panel 3 and the locking bar 21, Figures 5 and 6 show a side wall 66 with a through-window 67 for
20 the latching tab 25 as well as an auxiliary switch 68, which is fitted to the supporting limb 61 of the slide 42. In this case, in Figure 5, the operating apparatus is located in the position with the auxiliary disconnection contacts open. This can be seen from the
25 fact that the slotted-link arrangement 43 has been moved right to the front, and the auxiliary switch 68 with its switching arm 69 is resting on the inner face of the front control panel 3, or on a separate stop. The viewing window 48 in the shutter collar 47 is
30 positioned on the right-hand side above an appropriate inscription on the front control panel 3.

If the shaft 44 is rotated through approximately 270° to the right, this results in the slotted-link
35 arrangement being moved with the slide 42 to the rear, in order to engage the contact unit 14 (Figure 1) with the fixed-position contact unit 70. The switching arm

69 of the auxiliary switch 68 is in the process moved away from its stop, and signals the changed switch position.

- 5 Both figures 5 and 6 show two sections 71 and 72 of the worm gear with different pitches. During closure of the auxiliary disconnection contacts, the process first of all passes through the section 71 with the coarser pitch. In the process, the idling travel is passed
10 through, in order to allow the moveable contact unit to approach the fixed-position contact unit 70 from the disconnected position. The second section 72 of the worm gear 46 has a finer pitch and, in consequence, produces less movement of the slotted-link arrangement
15 for the same rotation of the shaft 44, which corresponds to a greater amount of force being exerted. The contact elements of the contact units 14 and 70 are engaged with one another along the section 72.
- 20 The slotted-link bodies 50 and 51 can expediently be produced in the form of moldings composed of metal or plastic using die-casting or injection-molding methods, respectively. In this case, the surfaces which are produced once the worm gear 43 has been joined together
25 are formed with all the required features by means of the walls of the die-casting or injection-molding mold, and are thus produced without any subsequent machining of the die-cast or injection-molded parts.
- 30 A known hand crank 28 (Figure 1) has already been mentioned as a tool for operating the shaft (34 in Figure 2, 44 in Figures 3 to 6). When required, this hand crank can be fitted to the described contour on the end face of the shaft (31 in Figure 2, 49 in
35 Figure 3), and for this purpose has an appropriately shaped mating piece. However, if the switching device withdrawable part needs to be operated frequently, it may be advantageous for it to be possible to operate

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the auxiliary disconnection contacts directly. This can be achieved by using a

tool 73 in the form of a rotary knob instead of the hand crank, as is shown in Figure 1. In this case, this rotary knob can be connected to the shaft of the operating apparatus by a suitable contour, in the same way. If removal is not envisaged or is undesirable, the rotary knob can be secured by suitable means such as a splint, splined pin or the like.

List of reference symbols

- 1 Switching device withdrawable part
- 2 Frame
- 3 Front control panel
- 4 Handle
- 5 Handle
- 6 Main disconnection contact (feed)
- 7 Main disconnection contact (outgoer)
- 8 Auxiliary disconnection contacts
- 10 Vertical busbars
- 11 Opposing contact
- 12 Arrow for movement of the switching device withdrawable part during insertion
- 13 Arrow for the direction of movement of the switching device withdrawable part during withdrawal
- 14 Contact unit
- 15 Slide
- 16 Operating apparatus (Figure 2)
- 17 Mounting plate
- 18 Main switch
- 19 Operating apparatus (Figures 3, 4, 5, 6)
- 20 Rotary handle
- 21 Locking bar
- 22 Pivoting arm on the locking bar
- 23 Pivoting arm on the locking bar
- 24 Latching tab
- 25 Latching tab
- 26 Threaded spindle
- 27 Hand crank
- 28 Tool for the operating apparatus 16
- 29 Operating apparatus (Figure 2)
- 30 Shaft (Figure 2)

31	Slotted-link arrangement
32	Slotted-link body (sheet-metal part)
33	Worm gear
34	Shaft
35	Dashed line
36	Control pin
37	Contour on the end face of the shaft 34
38	Arrow for rotation of the shaft 34
39	Arrow for movement of the slide 30
40	Section of the worm gear 33 (fine pitch)
41	Section of the worm gear 33 (coarse pitch)
42	Slide (Figure 3)
43	Slotted-link arrangement
44	Shaft
45	Control pin
46	Worm gear
47	Shutter collar
48	Viewing window in the shutter collar
49	Contour on the end face of the shaft 44
50	(Front) slotted-link body
51	(Rear) slotted-link body
52	End surface of the slotted-link body 50
53	End surface of the slotted-link body 51
54	Flange on the slotted-link body 50
55	Flange on the slotted-link body 51
56	Attachment opening in the flanges 54 and 55
57	Centering pin on the flange 54
58	Retaining opening in the flange 54
59	Recess in the end surface 53
60	Helical spring
61	Supporting limb on the slide 42
62	Attachment on the shutter collar 47
63	Step in the shaft 44

- 64 Connecting pin
- 65 Mounting limb on the slide 42
- 66 Side wall on the switching device withdrawable
part 1
- 67 Through-window in the side wall 66
- 68 Auxiliary switch
- 69 Operating arm
- 70 Contact unit (stationary)
- 71 Section of the worm gear 46 (fine pitch)
- 72 Section of the worm gear 46 (coarse pitch)
- 73 Tool (rotary knob)

Patent Claims

1. A switching device withdrawable part 1 for a switchgear assembly having auxiliary disconnection contacts (8) which can be closed or opened by means of an operating apparatus (16; 19) which is accessible from a front control panel (3) and is arranged on the switching device withdrawable part (1), with a contact unit (14) which is associated with the auxiliary disconnection contacts (8) being guided by means of a slide (15; 30; 42) on the switching device withdrawable part (1) such that it can move, characterized in that the operating apparatus (16; 19) has a shaft (34; 42) which is mounted in the switching device withdrawable part (1) such that it can rotate and can be operated by means of a tool (28; 73), and in that a slotted-link arrangement (31; 43) is fitted to the slide (15; 30; 42) and interacts with a control pin (36; 45) which projects radially from the shaft (34; 44).

2. The switching device withdrawable part as claimed in claim 1, characterized in that the slotted-link arrangement (31; 43) has a worm gear (40; 46) with at least two sections (40, 41; 71, 72) with different pitches, of which one section (40; 72) has an increased force step-up ratio, which is suitable for closing the auxiliary disconnection contacts (8) with respect to rotation of the shaft (34; 44).

3. The switching device withdrawable part as claimed in claim 1 or 2, characterized in that the slotted-link arrangement (43) is formed by two slotted-link bodies (50; 51), which are firmly connected to the slide (42), are hollow and cylindrical and are arranged coaxially with respect to the shaft

(44), and whose mutually facing end surfaces (52; 53) bound a worm gear (46) which holds the control pin (45).

4. The switching device withdrawable part as claimed in claim 2 or 3,
characterized in that
the worm gear (46) has a section (59) with an opposite
pitch at at least one end, and in that a spring (60)
which axially prestresses the slotted-link arrangement
(43) produces a latch for the shaft (44) in one end
position.
- 10 5. The switching device withdrawable part as claimed in one of claims 2 to 4,
characterized in that
the slotted-link bodies (50, 51) each have a radially
projecting flange (54, 55), and the slide (42) has a
15 supporting limb (61) which can be connected to the
flanges (54, 55).
- 20 6. The switching device withdrawable part as claimed in claim 5,
characterized in that
the flanges (54, 55) on the slotted-link bodies
(50, 51) and the supporting limb (61) on the slide (42)
are arranged parallel to one another and are connected
by means of continuous attachment means such that they
25 are aligned and cannot rotate.
- 30 7. The switching device withdrawable part as claimed in one of the preceding claims,
characterized in that
the shaft (34; 44) is provided at the end with a
contour (37; 49) for connection to a tool (32).
- 35 8. The switching device withdrawable part as claimed in one of the preceding claims,
characterized in that
the tool (73) is in the form of a rotary knob which is
permanently connected to the shaft (34; 44)